

a.

an animal model, comprising:

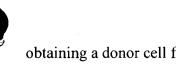
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- obtaining a cell from a donor animal;
- b. transferring the nucleus from said cell into a recipient oocyte or other suitable recipient cell to generate an embryo;
- c. isolating an embryo having at least one cell, an embryonic disc and/or stem cell from said embryo;

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- d. injecting said embryo, disc and/or stem cell into said donor animal at the same time as control embryonic disc and/or stem cell; and
- e./ examining the injection sites for teratoma formation.
- 2. The method of Claim 1, wherein said cell from said donor animal is transfected with a heterologous gene prior to nuclear transfer.
  - 3. The method of Claim 1, wherein said donor and control embryonic discs and/or stem cells are injected subcutaneously or into the paralumbar fascia.
  - 4. The method of Claim 1, wherein said teratoma, if formed, is removed and examined for the presence of germ layers.
- 5. The method of Claim 4, wherein the germ layers, if formed, are separated for the purpose of detecting or isolating specific cell types.

- 6. The method of Claim 1, wherein the cell obtained from said donor animal is a fibroblast.
- 7. The method of Claim 2, wherein said heterologous gene is a reporter gene selected from the group consisting of green flourescent protein (GFP), betagalactosidase, and luciferase.
- 8. The method of Claim 2, wherein said heterologous gene encodes a protein that is secreted.
- 9. The method of Claim 8, wherein said protein generates an immune response.
  - 10. The method of Claim 8, wherein said protein is a therapeutic protein.
- 11. The method of Claim 5, wherein the germ layer cells are further used in assays to evaluate potential developmental signals that control cell differentiation.
- 12. The method of Claim 5, wherein at least one type of cell found in the germ layers is used to engineer a tissue.
- 15 13. The method of Claim 12, wherein said engineered tissue is transplanted back into said donor animal to test immune compatibility.
  - 14. The method of Claim 12, wherein said engineered tissue is selected from the group consisting of smooth muscle, skeletal muscle, cardiac muscle, skin, kidney and nervous tissue.
- 20 15. A method of generating immune compatible tissues for transplantation, comprising:



- a. obtaining a donor cell from an intended transplant recipient;
- b. transferring the nucleus from said cell into a recipient oocyte or other suitable recipient cell to generate an embryo or fetus;
- isolating from the embryo or fetus a cell of the type required for transplantation; and
- d. engineering a tissue from said cells.
- 16. The method of Claim 15, comprising the following additional steps between said steps (c) and (d):

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- i. isolating an embryonic disc and/or stem cell from said embryo;
- ii. injecting said disc and/or stem cell into an immune compromised animal;
- iii. isolating the resulting teratoma;

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- iv. isolating from the teratoma a cell of the type required for transplantation; wherein said teratoma cell is used to engineer said immune compatible tissue.
- 20 17. The method of Claim 15, wherein said tissue contains cells comprised of isogenic nuclear DNA and allogeneic mitochondrial DNA.
  - 18. The method of Claim 15, wherein said tissue contains cells comprised of isogenic nuclear DNA and a mixture of allogeneic and isogenic mitochondrial DNA.

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- 19. The method of Claim 15, wherein said tissue is selected from the group consisting of smooth muscle, skeletal muscle, cardiac muscle, skin, kidney and nervous tissue.
- 20. A method of providing a patient in need of a transplant with an
- 5 immune-compatible transplant, comprising:
  - a. obtaining a donor cell from said patient;
  - b. transferring the nucleus from said cell into a recipient oocyte or other suitable recipient cell to generate an embryo;
  - c. isolating an embryonic disc and/or stem cell from said embryo;
  - d. injecting said disc and/or stem cell into an immune compromised animal in order to form a teratoma;
  - e. isolating the resulting teratoma;
  - f. isolating a cell of the type required for transplantation from the teratoma;
  - g. engineering a tissue from said cells; andh. transplanting said engineered tissue into said patient.
  - 21. The method of Claim 20, wherein said immune compromised animal is a skid or nude mouse.
  - 22. The method of Claim 20, wherein the donor cell obtained from said intended transplant recipient is a fibroblast.

- 23. The method of Claim 20, wherein said engineered tissue is selected from the group consisting of smooth muscle, skeletal muscle, cardiac muscle, skin, kidney and nervous tissue.
- 24. The method of Claim 20, wherein said engineered tissue comprises cells having isogenic nuclear DNA and allogenete mitochondrial DNA.
  - 25. The tissue engineered by the method of Claim 20.
  - 26. An isolated tissue generated by the method of Claim 20.
  - 27. The method of Claim 1, wherein said animal is an ungulate.
  - 28. The method of Claim 27, wherein said ungulate is a bovine.
- The method of Claim 15, wherein said animal is an ungulate.
  - 30. The method of Claim 29, wherein said ungulate is a bovine.
  - 31. The method of Claim 16, wherein said animal is an ungulate.
  - 32. The method of Claim 31, wherein said ungulate is a bovine.
  - 33. The method of Claim 20) wherein said intended transplant recipient is
- 15 a human
  - 34. The method of Claim 16, wherein said patient is a human.
  - 35. The method of Claim 16, wherein said donor cell is genetically altered prior to nuclear transfer.

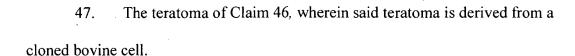
- 36. The method of Claim 35, wherein said genetic alteration comprises the transfection of at least one heterologous gene.
- 37. The method of Claim 35, wherein said genetic alteration comprises the disruption of at least one native gene.

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38. An animal containing at least one teratoma produced from a cloned

cell.

- 39. The animal of Claim 38, wherein said animal is an ungulate.
- 40. The animal of Claim 39, wherein said ungulate is a bovine.
- The animal of Claim 38, wherein said at least one teratoma is located in the paralumbar fascia.
  - 42. The animal of Claim 38, wherein said teratoma is not rejected by the animal's immune system.
  - 43. The animal of Claim 42, wherein said teratoma comprises cloned cells having isogenic nuclear DNA and allogeneic mitochondrial DNA.
- 15 44. A teratoma isolated from the animal of Claim 38.
  - 45. The teratoma of Claim 44, wherein the teratoma contains cells from all three germ layers.
  - 46. The teratoma of Claim 44, wherein said teratoma is derived from a cloned ungulate cell.



48. The teratoma of Claim 48, wherein said teratoma comprises eloned cells having isogenic nuclear DNA and allogeneic mitochondrial DNA, or a mixture of allogeneic and isogenic mitochondrial DNA.

- 49. A stable graft comprised of isogenic nuclear DNA and allogeneic mitochondrial DNA.
- 50. The graft of Claim 49, wherein the cells of said graft are made by nuclear transfer of an isogenic somatic cell into an allogeneic recipient cell.
- The graft of Claim 49, wherein said tissue is selected from the group consisting of kidney, cardiac muscle and skeletal muscle.
  - 52. A method of identifying mitochondrial histocompatibility antigens using cross-species nuclear transfer, comprising:
    - a. obtaining cells from a donor mammal;
- b. transferring nuclei from said donor mammal into at least two recipient oocytes or other suitable recipient cells of a mammalian species other than said nuclear donor to generate embryos, wherein said at least two recipient cells are allogeneic with regard to mitochondrial DNA;
- c. isolating an embryo having at least one cell, an embryonic disc 20 and/or stem cell from said embryo;
  - d. injecting said embryo, disc and/or stem cells separately back into said donor mammal as to generate a specific panel of antibodies and/or lymphocytes; and
  - e. comparing panels of antibodies and/or lymphocytes generated in response to said allogeneic mitochondrial backgrounds in order to identify

mitochondrial antigens and/or epitopes that are recognized by the immune system of said donor mammal.

- 53. The method of claim 52, wherein said embryo, disc and/or stem cells
  5 are injected into separate mammals which are isogenic to the nuclear donor with
  respect to both nuclear and mitochondrial DNA.
  - 54. Antibodies specific for the mitochondrial antigens identified in the method of Claim 52.
- 55. Lymphocytes specific for the mitochondrial antigens identified in the method of Claim 52.